

Technology in Physical Education

Action Research Project CI 515

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Introduction

Childhood obesity is on the rise, and physical educators are looking for ways to motivate and encourage their technology-savvy students to be more physically active. During the past ten years, technology use in physical education has shifted from mostly assessment tool-based such as fitness testing software and heart rate (HR) monitors to more student-focused technology, which promotes physical activity in creative and personalized ways.

This research project is focused on several new kinds of technology that are emerging for physical education classes, how this technology is impacting K-12 student participation, and physical education teachers' perspectives on the uses of technology within their classrooms. Observations were made at three different school districts which are all PE4Life model school sites including the original PE4Life school in Illinois. PE4Life is a national nonprofit program, which is funded by regional partners and promotes physical activity in a fun and interactive way through quality physical education programs. This program specifically endorses technology to get students active through interactive gaming, heart rate monitors, pedometers and other feedback tools (PE4Life).

The action research model utilized for this project is the Dialectic Action Research Spiral described by Mills (Mills, 2011) and illustrated below. An area of focus was determined and followed by collecting data through observations and interviews at the schools. Analysis and interpretation of data are reported in the findings section of this paper. An action plan for how this research can be utilized by physical educators and suggestions for future use of technology in physical education classes are also included.

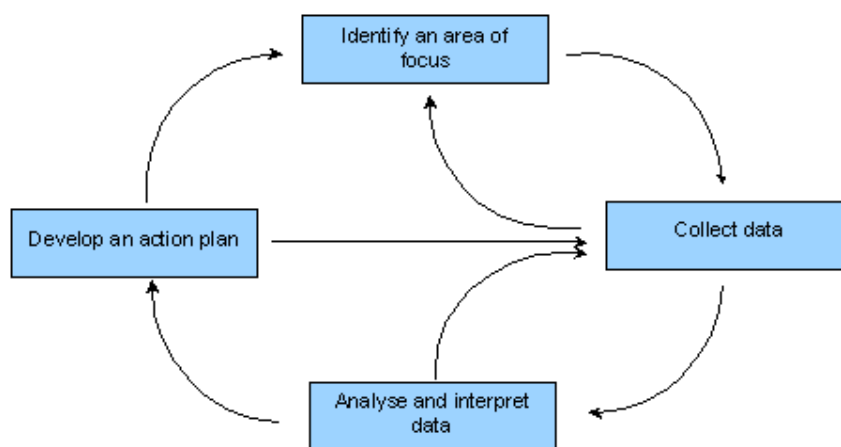


Figure 1. Dialectic action research spiral (Mills, 2011, p.19)

Area of Focus

The purpose of this study is to examine how technology integration efforts have affected selected K-12 physical education programs. The researcher interviewed three physical education teachers who are currently utilizing technology and observed two other teachers who did not participate in the interviews. This study focuses on each teacher's perception of how technology has impacted his/her students' activity levels, fitness levels and overall quality of the physical education program.

This research study included observations of physical education teachers, students and class structure to ascertain if the teachers' perceptions were comparable with what was occurring during class periods. Field notes were taken to examine technology usage by students and teachers as well as the technology in the gym spaces that are utilized during other class periods. Specifically, three districts were included for this project at five different schools in Illinois and Iowa. The following parts of action research will be covered in this paper:

Research Questions

1. How do physical education teacher participants utilize technology in their classrooms?
2. What are the teacher participants perceptions of using technology in physical education classrooms?
3. How does technology impact K-12 physical activity levels as compared to more traditional PE activities?

Review of Related Literature

Introduction

Childhood obesity has been on the rise for the past 30 years; and according the Centers for Disease Control and Prevention (CDC, 2011), 17 percent of US children are overweight. Wellness and medical professionals as well as physical educators have been keenly aware of the increased obesity rates of our children for many years. The realization is that this could be the first generation of children to have shorter life spans than their parents due to complications from obesity such as diabetes, stroke and heart disease. The advances in technology during the past 30 years have played a significant role in the increased obesity rates of our children. They

are spending more time in front of screens such as TV, computers and video games and less time being physically active than children in years past.

Nevertheless, during the past 15 years, the advances in technology have now begun to influence the physical activity levels among children and youth. These advances in technology which help to promote physical activity are now being utilized by physical educators in a variety of innovative ways. Fitness and activity levels in students improve through interactive technologies such as exergames, cardiovascular equipment and with videos that are projected on the wall for students to follow. Energy expenditure can increase with technology as well as keeping students motivated to participate. According to Lanningham-Foster et al. (2006), energy expenditure more than doubles when children participate in active screen time compared to sedentary screen time.

There are several types of technology that will be examined in this review of the literature. Mears (2009) suggests that there are three primary classifications for technology that are available in physical education which include physical activity monitoring/participation devices, platforms for dissemination of content information and tools for conducting assessments and maintaining student records.

This review of literature will classify the technologies into four categories:

1. Monitoring/assessment technologies
2. Technologies that encourage physical activity
3. Utilization of other creative technology tools in physical education
4. Teachers' perceptions of the integration of technology

Monitoring and Assessment Technologies

The oldest use and most familiar type of technology in physical education is for monitoring and assessing students. For many years, this was the only type of technology that physical educators used. Those technologies had really little impact on students except on their report cards. Fitness assessment software has been popular since the early 1990's as well as statistical analysis software mostly used by coaches. As described in the introduction, heart rate monitors and pedometers began to emerge for physical education classes in the early 1990's. The advances with heart rate monitors have gone from basic pulse monitoring to the capability of downloading a complete documentation of a student's heart rate during the entire physical education class.

Polar TriFIT assessment system is another technology utilized to evaluate student health and fitness levels. Teachers can create health profiles, customize exercise and nutrition programs and assess fitness levels of students which can all be integrated with heart rate monitoring (Polar n.d.-b). Polar also has an accelerometer as do several other companies which monitor students' activity using a wrist band or other tracking devices. Again, this information can be downloaded to a computer into the fitness assessment software or is also compatible with the TriFIT system.

Recently, other assessment technology tools have become available. During the late 1990's, the use of Personal Digital Assistants (PDA's) started to facilitate observational data collected by teachers on students' motor and/or social skills. Teachers collected data on the PDA and

transferred it directly to a computer for further data-management (Wegis and Van Der Mars, 2006). Teachers set up templates on the PDA and then transferred the data collected onto a spreadsheet. These electronic templates replaced the paper and pencil observations of the past with a more efficient means of collecting important student assessment.

The iPod has many uses for physical educators such as managing music, podcasting and most recently assessing fitness levels through an interactive wireless device which interfaces with the iPod called the Nikeplus sport kit which was released in 2006. This is really another form of a pedometer as it consists of a shoe sensor which inserts into a shoe and transmits a signal to a receiver which is attached to the iPod (Chen, Anton, and Helal, 2008). The Nikeplus gives assessment information to the user on steps taken and can even be interfaced with a heart rate monitor. Users can go to the Nikeplus website to upload information collected on their iPods and then track their data. This system is based on an accelerometer which emits an electrical signal when compressed. This signal comes from a mass inside the sensor that moves in reaction to acceleration by the user. The hardware can then send information on distance and pace which is calculated and shown with the iPod and can give users instant feedback in the form of congratulatory messages. Users can also set "power songs" for motivation and the information collected on the iPod can be downloaded to a computer for more data analysis and feedback (Tegtmeyer, 2007). Although there is very little literature specifically describing the use of the Nikeplus for physical education classes, this newer technology will certainly be useful for innovative teachers, especially at the secondary level, who are looking for new ways to motivate students and to collect more forms of assessment.

Many mobile phone devices are also starting to include applications for health improvement, fitness tracking and assessment as well as mobile interactive entertainment. Chick Clique is a cell phone application which is designed for small groups of teen girls to monitor steps taken and to give feedback through text messaging throughout the day. It promotes friendly competition among the group and was designed to raise fitness awareness (Connelly, Faber, Rogers, and Toscos, 2006). Apple offers many fitness and wellness applications as well for their phones, iPods and iPads which could be utilized in physical education classes or suggested to students as they plan their personal fitness and nutrition routines.

Technology began from mostly monitoring and assessment devices in the 1990's to more of the current interactive sophisticated pieces of equipment and video games which motivate and encourage physical activity. The next section of this review will include many technologies which are used in physical education classes to encourage students to be more physically active.

Technologies that Encourage Physical Activity

The first widely used types of technologies that supported physical activities in physical education classes and encouraged physical activities were wireless heart rate monitors and pedometers back in the early 1990's. The heart rate monitor was first invented by Polar in 1977 (Polar, n.d.-a) while the idea of pedometers to calibrate steps may go back to Roman times. Others credit Leonardo da Vinci or Thomas Jefferson for inventing the pedometer (Bassett and Strath, 2002). The modern digital pedometers were designed during the past 20 years. These

early technology tools for physical educators were and still are utilized mainly as monitoring or assessment devices.

Often, these tools require much time for teachers to learn the technology as well as class time for integrating them effectively into lessons. Physical educators are usually initially excited about the use of these assessment types of technology.(McCaughtry, Rocco Dillion, and Martin 2008). This research examined teachers' perspectives on the use of pedometers. In this study 26 elementary physical education teachers were given pedometers and attended a pedometer workshop to learn how they functioned. Interviews were conducted at the onset and throughout the six-month study. At the beginning, teachers were excited, motivated and pro-pedometer. But their mood increasingly grew pessimistic about the use of pedometers after integrating them in their lessons over several months. The teachers discovered that the use of pedometers had several organizational issues with getting them mounted on the children as well as the functionality of the units. Many teachers reported that the pedometers would not read the steps correctly or students attempted to build up their steps by shaking the pedometers. The pedometers also seemed to lack durability for long-term use in physical education classes. Despite the issues with the pedometers in this study the authors still recommended their use with some changes including using more mechanically sound pedometers and increasing the preparation for teachers in learning how to properly integrate them into their classrooms (McCaughtry et al.,2008).

During the late 1990's and early 2000's, other types of technologies began emerging for physical educators including the use of interactive virtual reality video games with life-like simulations (Mohnsen, 2005). Exergaming became the new buzz word to describe these video

games that involve physical activity. The games encouraged both individual and entire class participation. According to Mohnsen (2005), Dance, Dance Revolution (DDR), is based on a coin operated game that originated in arcades during the late 1990's where users follow a monitor with dance cues and participate on an interactive dance pad. Physical educators can now purchase or in many cases rent DDR games for a whole class of students to participate at once for a warm-up or entire cardiovascular lesson. Graf, Pratt, Hester, and Short (2008) reported that students who participated in games such as DDR or Nintendo Wii had 172 percent greater energy expenditure than watching TV or playing traditional video games. They also reported that with these exergames, an important feature was the motivation for students which comes through the entertainment factor of playing the games compared with traditional exercise regimens. Sell, Lillie, and Taylor (2008) also reported an increase in energy expenditure during a study they conducted on male college students using DDR. They noted those players who were experienced were playing the game at a higher level of difficulty which requires a higher physical activity level. Nadler (2008) reported that DDR helped with increased levels of physical fitness in the state of Virginia where the 765 public schools made DDR a mandatory part of all physical education curriculums state-wide. Ni Mhurchu, Maddison, Jiang, Jull, Prapavessis, and Rodgers (2008) also indicated in a 12-week study in New Zealand that children's (average age of 12) physical activity levels were higher for the intervention group that participated in active video games compared to the control group.

Trout and Zamora (2005) point out that the motivation factor of DDR for students is important as well as the innovative way it allows teachers to include fitness activities for their students. The lessons should progress from lesson to game mode as students begin to

participate in DDR. According to Hicks and Higgins (2010), interactive video games "provide personal, accurate, and immediate feedback through the scoring system" (p. 18). This immediate feedback is also motivating for students and can let teachers know at what intensity students are working and/or help them assess students' motor skill abilities.

In addition to the increased energy expenditure, physical fitness levels and the motivation of students with exergames, the time children are engaged in activities during physical education class may increase when utilizing exergaming technologies according to a study by Fogel, Miltenberger, Graves, and Koehler (2010). Researchers utilized seven types of exergaming technologies that were set up in an exergaming lab in stations. Students rotated among the stations for about 10 minutes at each piece of equipment. The students were engaged at a mean percentage of 78 percent with the DDR game producing one of the highest percentages at 94 percent engagement. The teacher involved with this study also reported a decrease in behavior problems and an increase in students following directions.

Children also seem to prefer the interactive video games especially those with music when given a choice. Epstein, Beecher, Graf, and Roemmich (2007) reported in a study that children ages 8-12 preferred to participate in the interactive DDR game compared to an instructional dance video. These interactive games which promote physical activity are fun, entertaining, motivating and offer challenges that traditional physical education lessons often lack. And, the novelty factor may also play a part in keeping students interested and engaged. Keeping this novelty factor in mind, it is important that physical educators utilize technology effectively without excess so that students continue to participate in a variety of activities with and without technology.

Besides DDR and the Wii game, Yang, Smith, and Graham (2008) explain some of the other exergaming technologies available for physical education classes. These include Sony's EyeToy which works with Playstation 2 consoles where players can control the games with upper body movements. The EyeToy has martial arts, boxing and dancing games. Cateye Fitness GameBike allows players to control racing games with sensors which are in the handlebars and pedals. Powergrid Fitness Kilowatt is an isometric exercise game where the player uses muscles with little or no joint movement by pushing and pulling against a rod which is attached to a controller while the torso moves and achieves isometric muscle contractions. Trazer by Cybex is a 3-D training simulator and gives instant feedback to the users about their position, heart rate and speed. VCycling uses a bicycle which is connected to the internet via a PC and gives players opportunities to race cyclists on courses from around the world. XaviXport converts player movements into on-screen movements to play games such as baseball, bowling and tennis. This exergame also has a lifestyle manager which can transmit data about the player such as weight and can then display personal health and nutrition goals and activities.

Other types of technologies can also be integrated into physical education that in the past may have been traditionally assimilated in academic classrooms. With the emergence of Web 2.0 tools, wikis, podcasts and blogs, they all open up new possibilities for physical educators.

Utilization of other creative technology tools in physical education

Physical educators have used other types of technology for many years such as the use of music to teach and motivate their students during lessons. Music has also been utilized for lesson organization and cues to help students know when to start, stop or transition to new

activities. As with classroom teachers, physical educators have used blackboards and whiteboards to teach sport strategies or historical information. And, many have utilized video cameras to help assess student motor skills or to teach content. But, now there is an abundance of new technologies to disseminate content information such as Web 2.0 tools and other newer technologies like iPods and iPads as well the assessment tool Nikeplus sport device which interfaces with the ipod.

Web 2.0 tools include a wide range of online sites, software and applications that are web-based and came into existence around 2004. This term was coined by Dale Dougherty to explain the emergence of newer web technologies (Anderson, 2007). Blogs, wikis, podcasts and countless websites with numerous programs and applications are specifically designed for educators. Web 2.0 tools help students to "collaborate on projects, consult experts and share data with the world" (Soloman and Schrum, 2007, p. 24). Many of these tools can also be utilized in physical education classes when PE teachers think creatively about using technology.

Wikis can be effectively used in physical education as studied by Hastie, Casey and Tarter (2010). This research examined the use of wikis with secondary physical education students in England. Each student team was given the task of designing an invasion game using a wiki which essentially extended the classroom from one lesson to a 24/7 classroom. The students shared their ideas within the wiki throughout the length of the project and promoted interdependence within each group of students. There were also social benefits of this project. "One offshoot of this extended community of practice and positive interdependence was the

empowerment of students who traditionally are not what we would call the superstars in physical education" (Hastie, Casey and Tarter, 2010, p. 86).

Podcasting and the use of video podcasting (Vodcasting) is another Web 2.0 technology tool in which students can use to supplement physical education lecture information, enhance teacher demonstration of skills or create a venue for cooperative learning with peers. Vodcasts can be used to help students with fundamental skills and rules, strategies and safety instructions with voice or text instructions (Schumack and Reilly, 2011).

Although this literature review did not reveal any studies with blogs in physical education, many educators have begun using blogging to document classroom activities. This can be a place where students can document their work and express their writing skills. MacBride and Luehmann (2008) found a high school mathematics teacher who used blogging for students to post information they learned in class as well as a location where the teacher could communicate beyond the classroom lecture time. Students asked questions, taught each other content and received timely answers from the instructor. As with wiki's, blogging allows 24/7 access to classroom information, and this format could easily be adapted for physical education classes as well.

All of these creative tools allow teachers to think about teaching physical education in new and innovative ways. Some physical education teachers have a vast knowledge about how to integrate technology into their lessons while others are just learning about all the possibilities available to them. Examining teacher perceptions is critical for the successful infusion of technology into physical education programs.

Teacher Perceptions on the Integration of Technology

So, what are teachers' perceptions of integrating technology into their classrooms? This literature review found very little research specifically targeting physical education teachers and their perceptions with technology. A study in Britain revealed that physical educators welcomed the integration of technology into their classes and valued the use of technology with adequate training to properly utilize the technology in effective ways (Thomas and Stratton, 2006). Adequate training time seems to be essential for success or frustration by teachers. The pedometer study mentioned earlier by McCaughtry et al, (2008), revealed that physical educators did have an interest and enthusiasm for technology at the onset of the new integration effort. But, as reported, the teachers' perceptions changed significantly as they began to utilize the pedometers with students because of the lack of durability of the technology and lack of management methods to facilitate efficient use of the pedometers with elementary students. Perhaps if these teachers would have had another professional development opportunity or a way to share ideas and frustrations among themselves, their experiences would have been much more positive. (Baylor and Ritchie, 2002) concluded that, "regardless of the amount of technology or its sophistication, technology will not be used unless faculty members have the skills, knowledge, and attitudes necessary to infuse it into the curriculum" (p. 398). Professional development also helps teachers become more open to using technology in their lessons especially for more experienced teachers who have likely taught without it for many years. When teachers feel more comfortable with software, hardware or a Web 2.0 tool, they will be more inclined to infuse technology into everyday

lessons which Baylor and Ritchie (2002) revealed in their research when they interviewed teachers.

Summary

The literature examined in this area review featured many different types of technologies that can be utilized in physical education classes. Clearly, exergaming has exploded as the latest and greatest new physical education technology and DDR in particular is the most widely used exergaming system being implemented across all grade levels. These interactive video game systems are costly so schools on tight budgets may find it more difficult to infuse them into their curricula. Many schools are now renting DDR systems for several weeks at a time. Some larger districts have started sharing a classroom DDR and rotating it among their schools which is rotated throughout the school year.

Like other content area teachers, physical educators have begun the use of blogs, wikis, podcasting and Web 2.0 tools. All of these technologies help teachers to expand classroom material and encourage dialogue and social interactions for students. This is especially important for those teachers, like physical education teachers, who see their students more infrequently.

Heart rate monitors continue to be utilized by physical educators, but may be more difficult to implement at the elementary level where classroom management issues may cause similar frustrations as pedometers. Secondary teachers should have better results with older students who are more able to secure the hardware and transition from one class to another with longer class periods, and in many cases, more frequent class periods per week. Other management

devices such as PDAs have begun to assist physical education teachers in assessing students in more efficient ways. And, newer technologies such as cell phone apps., the Nikeplus system and the TriFIT system are able to keep track of fitness and health data to more effectively assess students and report results to parents and administrators.

Physical education teachers, like many other educators in schools, are in need of professional development opportunities to utilize and implement technology effectively. Having the technology does not equal good pedagogical practice of it. Teachers need high-quality instruction, time to practice using technology hardware and software and time to collaborate with others on the best way to use and implement the technology. All this can be achieved when school districts and teachers work together to accomplish what is best for their students.

Intervention/Innovation

The innovation for this research project was to observe and collect information from current physical education teachers regarding some of the latest technologies available for physical education classrooms and their perceptions on how those technologies are being infused into lessons. Because these teachers are distinguished in the field of technology and physical education and have PE4Life model sites, they were chosen for this study.

The greatest piece of information that can be taken from this project is that these teachers are excellent in their field and have been recognized by the PE4Life organization and by national educational professionals as model schools. Other educators can learn a lot by observing how these teachers obtained funding and are now using technology to improve

student participation and learning. All three of these programs have been featured on local and national news, in numerous publications, and at educational conferences.

This research project will now assist the researcher to disseminate the information and share it with other teachers and administrators in professional development classes and workshops. It is the goal of the researcher to also be able to take the information and implement ideas and techniques into the physical education classroom. In addition, further study is needed and additional observations need to be completed to determine how other physical educators are infusing technology into their classrooms.

Membership of the Action Research Group

For this research project, three teachers participated and physical education programs were observed in five schools in Illinois and Iowa. Teacher participant #1 is in his first year of retirement from a large affluent suburb of Chicago but is still very involved with the physical education program and is the person who initiated the use of technology in physical education classroom in the early 1990's. He discussed technology for K-12 students at three different schools in his district, but mostly focused at the high school level. Teacher participant #2 was in a large city in Iowa and teaches K-5 physical education. Teacher participant #3 teaches K-5 PE in a rural Iowa school district. All three participants have extensive physical education teaching experience, and all of their schools are model sites for the PE4Life program which is explained in the negotiations section.

Negotiations to Be Undertaken

Before this research project began, the three school districts were identified through personal knowledge of the researcher and from the schools' accreditation through the PE4Life program. The PE4Life schools utilized for this study were one high school, middle school and elementary school in Illinois one elementary school in a large city in Iowa and one elementary school in rural Iowa. Initial contacts were made to physical education teachers through e-mail and phone calls. Because these schools were PE4Life sites, they have regular visitor observations numerous times during the school year so the administrators were not contacted for these observations. Specific teacher or school names were not utilized and information for data analysis and reporting. Numbers were assigned to each school and teacher for confidentiality.

Timeline

- Phase 1 (January -February 2011) Identified area of focus, developed research questions, identified possible teachers and school districts.
- Phase 2 (March 2011) Teachers contacted, interview questions developed. Traveled to schools for observations and data collection.
- Phase 3 (April 2011) Data analyzed, findings reported, and an action plan developed for further study and recommendations.

Data Collection and Analysis

Data collection was completed at three school districts in Iowa and Illinois with three teacher participants through observation, field notes and interviews. The following table illustrates the research questions and the data sources that answer these questions.

Research Questions	Data Source 1	Data Source 2
1. How do physical education teacher participants utilize technology in their classrooms?	Field Notes, Observation	Interview
2. What are the teacher participants perceptions of using technology in physical education classrooms?	Observation	Interview
3. How does technology impact K-12 physical activity levels as compared to more traditional PE activities?	Field notes, Observation	Interview

Table 1

The physical education teacher participants were all utilizing a variety of technology in their classrooms. Through observation and field notes, Table 2 indicates the technology observed in these physical education programs.

Technology Types	Teacher 1	Teacher 2	Teacher 3
Physical Activity Improvement Devices	Multiple interactive cardio machines, DDR, Brain bikes, Bike connected to Internet, Cybex bike, LCD projector for videos, interactive smart board, Makato light/sound board	Lightspace wall, LCD projector for videos	LCD projector for PowerPoint slides and videos

Monitoring or Assessment Devices	HR Monitors & software, TriFits	Fitnessgram software	HR Monitors, Activity Monitors, Fitnessgram software
Management or Lesson Planning Devices	Multiple Laptops, PA systems w/music & headset microphones, Whiteboards	Laptop, PA system w/music & headset microphone, Timer, Whiteboards	Multiple Laptops, PA system w/music & headset microphone, Pocket PC, Timer, Whiteboards

Table 2

As Table 2 indicates, a variety of technology devices were utilized by all the physical education programs observed. When asked how this technology is funded, all three teachers indicated that they utilized local and national grants as well as fundraising efforts to begin the technology equipment funds. Much of the technology at teacher participant #1 schools focused on exergaming and cardiovascular exercise equipment. Heart rate monitors were integral to the secondary schools for his district, and he reported that over the years these monitors had identified several medical issues with students. In one case, a student was flagged with a possible heart problem using the HR monitor and was referred to a cardiologist who discovered a severe heart condition in the student (Teacher participant #1, personal communication, March 12, 2011). At participant #2's school, a large Lightspace wall was observed. Students use this wall for every physical education class and interact using a windows compatible computer that interfaces with the wall. The Lightspace wall provides several games that students participate in by hitting the multi-colored spaces with their hands or with a medicine ball. "The Lightspace wall is visually motivating plus the students are constantly passing and catching a med-ball while working out" (Teacher participant #2, personal communication, March 25, 2011).

All three teachers agreed that the use of technology in their physical education programs was an important part of tapping into their students' visual world and helps to engage students. "I think that the technology piece really engages students more and invests students more" (Teacher participant #3, personal communication, March, 31, 2011). "We are in a visual society where we need to utilize technology for us and not against us" (Teacher participant #2, personal communication, March 25, 2011).

Monitoring and assessment devices varied: 1) fitness software to store and report fitness testing measurements; 2) an interactive TriFit system which collects student fitness data from a piece of equipment and downloads it to a computer; 3) heart rate and activity monitors which students wear collect information that is downloaded through a docking system on a computer and is stored and analyzed in a software program.

Management technology included laptops which did everything from lesson planning, running fitness software, managing music for play during class to projecting PowerPoint slides and videos via the LCD projectors. All three participant schools used a PA system with headset microphones and music for motivation and management of students. Whiteboards were observed for posting management directions to students at all schools. Teacher #3 had a pocket PC or also known as a PDA. He utilized this device for lesson planning and assessment of students during class time.

Teacher participant perceptions of technology were very similar. All three participants had been teaching for over 25 years and began their careers with very little or no technology. Therefore, they had taught themselves and learned a great deal about the technology from

professional development opportunities, as well as from colleagues and from practice on their own. They had to retrain themselves in the way in which they delivered physical education content. They all indicated that utilizing technology in physical education is important to engage and keep students interested in their subject matter. "By embedding technology, we're bringing learning more readily available to all students" (Teacher participant #3, personal communication, March 31, 2011). Teacher participant #1 even discussed how his interest with technology in physical education is now spilling into other classrooms. At his school, they have just installed interactive whiteboards on two full walls of new classrooms and more anatomically correct triangular desks and chairs which promote movement. He said they have done a lot at their high school to promote brain-based learning and that technology has been a key in this transition from more traditional physical education classes and academic classrooms to more interactive action-based teaching. He was very positive about all ways in which technology is being infused to physical education and with his help into the other classrooms (Teacher participant #1, personal communication, March 14, 2011).

All the uses of technology have impacted activity levels for all three of the teachers students. They all reported that obesity levels were well below the national level of 17 percent. Because both participant #1 and #3 have daily physical education, this would also affect the obesity levels of students. But, many of the fitness activities in which students participate involve some kind of technology. At a minimum, these physical education programs utilized music and the LCD projectors extensively. At the large district in Illinois, secondary students were using the cardio rooms at least twice per week with the interactive fitness equipment. At teacher #2's

school, he infused the Lightspace wall with other fitness oriented centers so students rotated through 4-6 stations which all focused on fitness for part of each class period.

Findings

After analyzing and interpreting the data, several themes emerged which relate back to the original research questions. The following themes have surfaced from the analysis of data.

Teacher participants:

- Utilized multiple kinds of technology integration in their physical education classes.
- Have an intense passion for going ahead of the field of physical educators. They each had pioneering ideas about uses of technology.
- Expressed importance of professional development and future opportunities to learn more about technology.
- Explained how a variety of kinds of technology can encourage students to become more physically active.

Multiple Types of Technology

The first research question for this project is: How do physical education teacher participants utilize technology in their classrooms? From observation and from the interview process, these teacher participants are using a lot of technology in their physical education programs. The ultimate goal in the use of the technology in their programs is to keep students physically active during class and to prepare their brains for learning in other classrooms. Each teacher participant utilized interactive technologies as well as monitoring and assessment technologies. See Table 2 for a full description for each participant. Participants in the research project had similar experiences to what was reported in the

review of literature. Exergames are motivating for students (Trout and Zamora, 2005), they help students to stay more engaged during class (Fogel et al, 2010) and have a high energy expenditure (Ni Mhurchu et al, 2008).

Each teacher participant used a variety of monitoring devices such as heart rate and activity monitors, TriFit system, and fitness data software. Each participant school had some unique kinds of technology for its students from the Lightspace wall, using LCD projectors for integrating PowerPoint during class activity time, videos and equipment such as the brain bikes and other interactive cardio equipment.

Passion for Leading Others in Profession

Each of the participants is a leader in utilizing technology in physical education. All three often share their expertise with other physical educators since they are PE4Life model sites and have frequent visits from other professionals. They also present their ideas at conferences. Teacher participant # 1 even has an onsite conference right at his school to teach other teachers about technology integration and how his district works to improve physical activity and brain readiness for learning. All three participants were passionate about their subject matter and how technology has helped to play a significant role in building their programs to some of the best across the US. Participants #1 and #3 have had national TV and press coverage while participant #2 has had several local TV and newspaper articles showcasing his Lightspace wall.

This passion for leading other professionals and using technology is an important piece of information that was revealed through this research project. Many physical educators are infusing technology ideas into their programs, but the three programs observed go way above and beyond what most physical educators are able and willing to do with technology.

Importance of Professional Development

All three participants emphasized that professional development is an important piece to learning and utilizing technology which was also discussed in the literature review. Baylor and Ritchie, (2002) as well as Thomas and Stratton, (2006) discussed the importance of adequate training for teachers for them to be effective in technology infusion. This adequate professional development is certainly important in helping to shape teachers' perceptions. When teachers have help with learning how to effectively use a piece of technology, they will be much more willing to do so and be successful. The participants in this study have all spent significant time learning how to effectively use technology. They are all active members in their professional organizations and have spent numerous hours learning how to use the technology their schools have purchased.

When teacher's do not receive adequate training, their perceptions of the technology can be more negative as was revealed in the study by McCaughtry et al (2008) which followed a group of physical educators who were given pedometers. Initially the teachers where excited about integrating the pedometers into their classes. But as time progressed, they became frustrated and were not given enough training time for effective integration. So, effective professional development is key for teachers to successfully integrate technology into physical education.

Technology Encourages Physical Activity

Through observation of these three programs and from the interviews, technology integration seems to be promoting more physical activity compared to traditional physical education lessons. However, much of what each of these three participants do is to utilize technology with the traditional lessons or alongside them versus just using technology to

improve fitness or physical activity levels. For example, at participant #2's school, the Lightspace wall is used as a center or station along with other centers of more traditional fitness activities. Yes the wall promotes physical activity, but really the design of the lesson by an excellent teacher is the key component. At participant #3's school, the LCD projector is utilized extensively to facilitate locomotor and fitness skills as well as the organization of the class. This is a new and innovative idea using technology to keep students more on-task and to keep their heart rates elevated. However, the key for this teacher is the planning and organization of the lesson to effectively use the technology.

At the secondary level for participant #1's district, many of the pieces of equipment used to facilitate fitness are directly tied to technology. For example, the interactive cardio equipment, Makoto and use of videos all have fitness as their primary focus. But again, these technologies are often used alongside more traditional pieces of fitness equipment such as weight machines. And, students in this district still take several quarters of more traditional physical education activities such as swimming, team sports and dance. Technology is a very important piece of this program, but the pedagogy and planning of the lessons come first.

Researcher's Insights

As a former physical education teacher, I related to much of what the findings revealed from both the literature review and from the teacher participants who were observed and interviewed. When I was teaching, I attempted to integrate heart rate monitors and quickly became frustrated as I lacked sufficient professional development training. As the literature by McCaughtry et al (2008) disclosed about teacher perceptions of using the pedometers, I also had a similar experience. Initially, I was very excited to integrate the four heart rate monitors

into my 4th and 5th grade physical education classes. But, I discovered that the amount of time it took to get them on the students and working properly took too much of the 35-minute class period time. I also did not have the capability to download the data to the computer so eventually I mostly abandoned the idea of trying to integrate them into class.

I have always been a teacher who is involved in my profession and from my state organization knew both of the teacher participants from Iowa in this study. The third teacher participant was a speaker at one of our conventions several years ago, so I was very familiar with his program in Illinois. I too tried to be a passionate leader for others in physical education when I was teaching. I still attend the yearly convention and have presented information numerous times on various topics to improve pedagogical practices in physical education.

It has been seven years since I taught physical education and the technology has changed significantly since then. I did not have a technology fund with which to work, but believe that if I get back into the classroom, I will have many more opportunities to integrate technology into physical education lessons. I was able to learn many new ideas in how technology can play significant roles in student participation in physical education.

Action Planning

The intension of this action research project was to focus on technologies that are emerging for physical education classes, how this technology is impacting K-12 student participation and physical education teachers' perspectives on the uses of technology within their classrooms. I wanted the opportunity to observe some PE4Life schools where I knew technology was an important part of the program.

Three physical education teacher participants were observed and interviewed to ascertain their perceptions as well as gain insight into a variety of technology that is currently available for physical education programs. Transcripts of the interviews were analyzed for common themes and a review of the related literature was completed.

One of the major things that I learned with this project is that obtaining grants and other funding sources outside of the regular school budget is significant in being able to obtain these expensive kinds of technologies for physical education. Working with other physical education teachers within your district is important to be able to share equipment and write grants together. Being persistent is also very important. Teacher participants #1 and #3 both mentioned this as they began their quest for obtaining the technologies for their programs. They did not take 'no' for an answer from administrators when confronted with financial or other obstacles. They found alternative ways to fund the equipment which was key to them being successful.

Based on the information observed and discovered through this project, several ideas have been realized where I can further the research and share it with others in the future. Since I am not currently teaching physical education, I may not be able to directly carry out implementing technology in my own classes. Should I obtain a teaching job, I plan to utilize several of the ideas including utilizing an LCD projector to help facilitate classroom organization, activity monitors, videos, music and fitness software. Ideally, I would like to further this research by observing more teachers who are currently using different types of technology and then share that with my colleagues and others in the field of education. This research study may give me the opportunity to share my findings at a future state conference with other physical educators.

I currently teach several Area Education Agency (AEA) Classes in the summers for teacher relicensure, as well as other workshops for educators, and will be able to use the knowledge from this research project with these groups. It is my intent to show teachers what is possible with technology and how they might be able to integrate more technology into their classrooms. Since most of the educators that are in my classes are regular classroom teachers and not physical educators, the technology ideas that facilitate academic learning such as the Action Phonics with the LCD projectors, music and videos will be especially helpful.

I may also create an AEA class for physical educators to not only share this information, but to teach them about different kinds of technology and how it can be utilized in the classroom. I believe it would be very helpful for physical education teachers to have a technology class that is specifically designed for their needs. After this project, I believe I have a good start on information that could be used for a two-day class. At a minimum, I think I will teach a short session on technology at our next state Iowa Association for Health, Physical Education, Recreation and Dance (IAHPERD) convention in the fall.

This project has been a valuable experience, and I really gained a lot of insight and knowledge by observing and visiting with three outstanding physical educators. It is my intension to continue learning and developing technology skills in physical education. I really hope to be able to attend the national convention in the near future where they have an entire day devoted to exergaming for physical education.

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Appendix A

Survey Questions--Master summary from all 3 teacher interviews

1. What are the current technologies that are utilized for teachers and students in PE classes at your school?

Teacher #1-

HS= 7 physical activity areas with HR Monitors, Multiple(over 50) interactive fitness/cardio equipment, TV monitors, PA systems with headsets and music, DDR, TriFits, Brain Bikes, LCD Projector mounted in ceiling, Multiple Laptops, Videos, Interactive smart light boards

MS=2 physical activity areas with HR Monitors, Multiple(over 40) interactive fitness/cardio equipment, Makoto Light/Sound board, DDR, Interactive bike connected to internet, PA systems with headsets and music, TriFits, LCD Projectors, Multiple laptops

Elementary=Large gym space with LCD projector, laptop, PA system with headset and music

Teacher #2

Moderate gym space with interactive light space wall, white boards, LCD projector on cart to project videos, lap top, large timer, activity monitors, PA system

Teacher #3

Large gym space with HR monitors, activity monitors, PA system with headset microphone, LCD projector mounted in ceiling, Laptop for playing music and projecting PPoint on LCD, Timer/Scoreboard, Large Lazer printer, Pocket PC, Office Laptop for management

2. How many classes/students do you teach each day?

Teacher #1

Daily PE for secondary students, 2 x's/ week for Elem. Classes are: HS=5, MS=? Elem.=10

Teacher #2

PE 2x's/week for 45 min. Teaches 7 classes/day

Teacher #3

Daily PE for 35 min. Teaches 13 classes/day(Has 2 graduate students from UNI helping with this)

3. How often do students participate in activities with technology integration?

Teacher #1

HS= Depends on the unit as they have 28 different ones required during 4 years& students must take at least 6 fitness units which use technology every day. When they take something like swimming, not as much technology used by students.

MS= Every other day they are in the cardio room using the technology. When in the gym, still using PA system and laptop.

Didn't ask **Elem** but appeared to also depend on the unit and she admitted that she did not use as much technology as secondary schools.

Teacher #2

Daily with the Lightspace wall and then other technology integrated at various times.

Teacher #3

Daily with variety of technology

4. How do you fund technology for PE?

Teacher #1

District= PE budget, PEP grant, PE4Life and other grants to start, Booster club, Fundraisers, Parent donations, Directs technology camp for other teachers to come to Naperville and makes some money from the fee, School technology funds.

Teacher #2

PE budget, PE4Life access to organization which gave grants

Teacher #3

Grants from community, PE4Life, other organizations, technology funds

5. What technologies would you still like to integrate for your PE classes?

Teacher #1

HS=Nintendo DS, Flash focus which helps with tracking

Teacher #2

Track student data with I-Pad

Teacher #3

Activity monitors

6. How has the technology affected fitness levels for students?

Teacher #1

Students in district are way below average for obesity levels compared to national average, fitness levels are also affecting classroom performance. Kept track of data for zero hour PE

students who use fitness equipment before school and then go to a class right after where they had struggled in the past. Equipment engages students.

Teacher #2

Light space wall is visually motivating plus the students are constantly passing and catching a medi-ball while working out.

Teacher #3

The technology engages students more than traditional lessons. Visual cues help to keep students active which helps those students with different learning styles. The technology engages and invests students more

7. How has the technology integration affected student participation?

Teacher #1

More engaged through the technology with things like videos, Wii, DDR, light boards, fitness equipment, HR monitors. The technology helps students to stay motivated. For example, in the cardio room, they were playing a movie on the screens while students were working out and also use music extensively as a motivation for participation.

Teacher #2

Participation is usually good at Hanawalt and now technology has raised the bar higher with new challenges. We are in a visual society where we need to utilize technology for us and not against us.

Teacher #3

Visual technology helps students with different learning styles. The technology engages and invests students more. For example, the visual phonics PPoint that is projected up on screen cues students for motor movements and also use for classroom management. Use music extensively to motivate from CD's, ipod and YouTube videos.

8. How has your lesson planning been affected when integrating technology?

Teacher #1

Overhaul since we started technology integration. Need to plan lessons with the student interaction in mind.

Teacher #2

In the beginning stages, implementing new technologies usually takes more time. But, eventually it should level off.

Teacher #3

Uses a pocket PC which can be synched to laptop and beamed to other PC's which is helpful with

UNI students. Puts lessons in Dropbox online which has helped a lot. Uses a PE manager program to keep things organized and plan lessons.

9. How did you learn to utilize the technologies? (Professional development, on your own, AEA class etc.)

Teacher #1

Staff development days, from each other, use flip cameras to capture something and then share with others, own practice and trial and error.

Teacher #2

State conventions, workshops, professional development, AEA, Bonnies Fitware and a lot of practice on own.

Teacher #3

Professional development and hands on own, UNI students share a lot.

10. What if anything would have assisted you in learning or implementing the technologies?

Teacher #1

Did not answer

Teacher #2

New principal is technology savvy and has motivated the staff to use share point on the district website.

Teacher #3

More professional development

11. Any other technologies you plan to implement in the future for PE classes?

Teacher #1

Did not answer

Teacher #2

Website, but other than that just content and want to become more efficient with what I have.

Teacher #3

Activity monitors which can reach outside of PE time

Common themes from interviews.**1. Types of technology utilized**

HR monitors, LCD projector, PA, laptop computers, timing devices, interactive technology

2. Funding sources

PE4Life, grants, school technology funds

3. Fitness levels of students

High fitness levels compared to national average

4. Engaging students

Technology is engaging for students

5. Learning of technology

Lots of personal practice, professional development

6. Passion of learning and teaching about technology

Appendix B

Field Notes form-- PE Technology Observations

School: _____

Teacher: _____

Date: _____

Grades: _____

Physical Setting with observable technology:**Activities using technology:****Participation by students:**

Quotes/Comments by teachers related to technology:

Quotes/Comments by students related to technology